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NOTIFICATION

State Policy on Solid Waste Management Strategy

This shall come in force w.e.f. the date of publication in the official Gazette, Government of Sikkim.

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Secretary
Urban Development & Housing Department**

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1. Abbreviations

- a. SWM - Solid Waste Management
- b. RM&DD - Rural Management and Development Department
- c. UD&HD - Urban Development & Housing Department
- d. ULB - Urban Local Body
- e. GPU - Gram Panchayat Unit
- f. MEO - Municipal Executive Officer
- g. RDO - Rural Development Officer
- h. VAA - Village Administrative Assistant
- i. LEM - Local Environment Manager
- j. MRF - Material Recovery Facility
- k. RRC - Resource Recovery Centre
- l. CFL - Compact Fluorescent Lamp
- m. NGO - Non Government Organisation
- n. SHG - Self Help Groups
- o. NHG - Neighbourhood Groups
- p. EPR - Extended Producer Responsibility
- q. SLAB - State Level Advisory Board
- r. SLAC - State Level Advisory Committee
- s. IEC - Information Education and Communication
- t. LED - Light Emitting Diode Bulb
- u. DC - Direct Current
- v. KCC - Khangchendzonga Conservation Committee
- w. PVC - Poly Vinyl Chloride
- x. WWF - World Wild Fund
- y. ECOSS - Eco- Tourism & Conservation Society of Sikkim

The pursuance the provision of clause (a) of rule 11 of the Solid Waste Management Rules, 2016, the following State Policy and Solid Waste Management Strategy for the state and hereby laid down, namely;

2. Introduction

Solid Waste Management has emerged as an urgent issue to both human settlement and the environment because of its evolving nature. Century old method of managing solid waste has resulted in numerous human rights and environmental violations. Pioneers in sustainable development are looking at solid waste management through a decentralised approach. United Nations Environment Program (UNEP) has recognised Alappuzha (India) along with Osaka (Japan), Ljubljana (Slovenia), Penang (Malaysia) and Cajica (Columbia) as cities that fight pollution through sustainable solid waste management. Solid Waste Management Rules, 2016 clearly defines a decentralised approach to waste management. However, the concept of Decentralised approach to solid waste management is not new to Sikkim. Ministry of Tourism, Government of India along with the support of UNDP initiated Endogenous Tourism projects across India during 2006-08. Lachen in North Sikkim was one of the villages identified under this national level project. Lachen with the support of Endogenous Tourism Project followed Zero Waste to address the waste issues in the tourism destination. It was improved and expanded with the support of Gram Panchayat Unit and local NGOs. It was the first initiative of Zero Waste in Sikkim. Many NGOs and other community based organizations in Sikkim who were already working on the issue of waste, geared up and consolidated the State level campaign to Zero Waste Sikkim where Government of Sikkim joined the movement. The Mountain Initiative, WWF-India, KCC-Yuksam and ECOSS -Sikkim were in the forefront of the movement to build Zero Waste Sikkim. Swachh Bharat Mission (Urban), Sikkim promoted Zero Waste in the State in a formal way through organizing skill share workshops, awareness campaigns and through motivating Local Administration Units. The Zero Waste initiatives in Sikkim invited national and international attention. The experiences of Lachen village, Khangchendzonga National Park trekking trails, initiatives in Tsomgo Lake, comprehensive ban on disposable plastics by Jorethang Village, Zero Waste events, Zero Waste Crafts etc added to the momentum to place Sikkim as the first Zero Waste State in India.

This is the next step by Government of Sikkim to consolidate the experiences of a decade into a policy on solid waste management, Urban Development & Housing Development and Rural Management & Development Department has taken initiative to explore the waste issues in the state and to develop long term policy recommendations with the help of Khangchendzonga Conservation Committee (KCC) in coordination with Thanal, Kerala for all Local Bodies in the state.

3. Scope

The policy is limited to Solid Waste Management & Plastic Waste Management. However collection of E-Waste, Construction and Demolition Waste and Domestic Hazardous Waste from public is envisaged in the document.

Bio medical Waste, Radioactive Waste etc requires higher and complicated technical know-how and protocols for its safe handling. Bio medical Waste Management Rules 2016 lays down protocols for managing bio medical waste from health care facilities and laboratories. Sikkim being one of the hubs of pharmaceutical industry, it is recommended to form a separate policy involving stakeholders.

Solid Waste Management Rules, 2016 entrusts the local authority for the implementation of Rules. Hence it is assumed that the State Government will provide financial assistance, human resources, land, develop Byelaws and Regulations.

4. Vision & Mission

4.1 Vision

Establishment of Zero Waste systems for Solid Waste Management in Sikkim state by the year 2030.

4.2 Mission:

Enable the community to visualize experience and own up utilization of resources along with conservation of environment for sustainable development.

5. Characteristics of Waste

The State of Sikkim generates less than 90 metric tonnes of waste per day. More than half of it comes from the only class 1 city in Sikkim – Gangtok Municipal Corporation (Source: Census 2011 & State Pollution Control Board). The percapita waste generation per day is about 125 grams only (as per calculation & analysis). It is very low compared to the national average. The characteristics of Waste in Sikkim are represented in the following charts. Figure 1 clearly shows that the bio degradable or organic fraction of the waste dominates in the solid waste stream which is about 57%. Paper and glass bottles are among the major discards in the State contributing about 35.8% and 40.6% respectively of the total waste (See Figure-2). Among plastic waste, ice cream cups dominate the plastic waste stream with 22.2%. PET bottles of drinking water and soft drinks add up to 19.5%. Milk sachets and tetra packs contribute about 13% each.

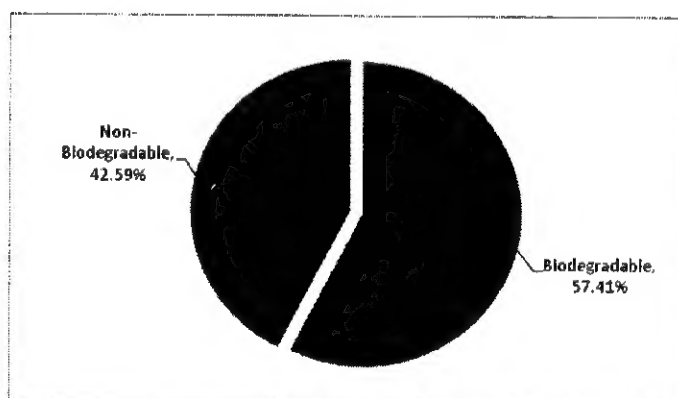


Figure 1 Composition of Waste – Sikkim as per waste audits from households

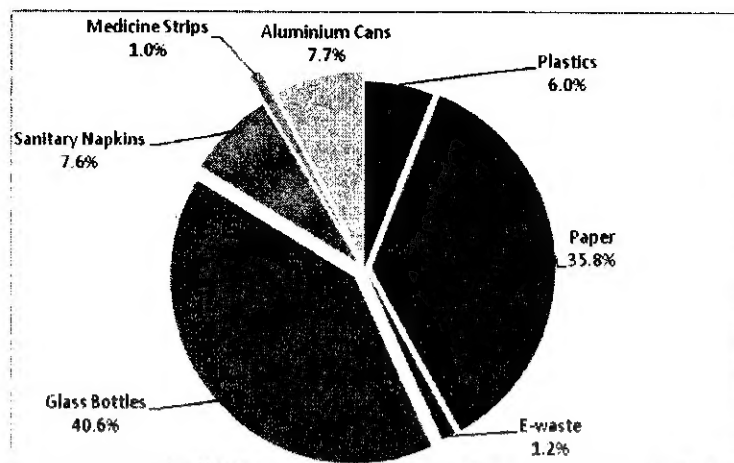


Figure 2 Non Bio degradable Waste – Sikkimas per waste audits from households

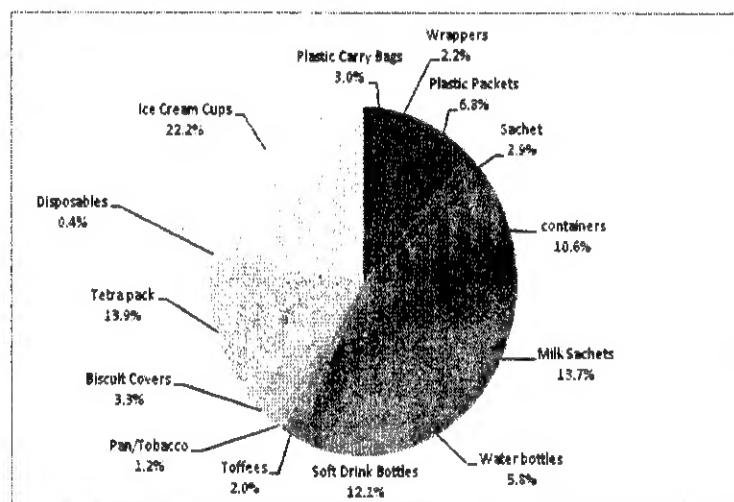


Figure 3 Plastic Waste –Sikkimas per waste audits from households

6. Challenges in Waste Management

Sikkim, one of the smallest states in India which have a population of 6.6 lakhs (estimated for year 2018 based on census 2011) and enjoys a human development index of 0.57 and is one among top ten States of India. Interestingly the floating population of Sikkim which is dominated by tourists accounts for another 5 lakhs, thus making the population in the state more than 10 lakhs. The density of population is 86 persons per sq.km. However there is a peaking trend of density near urban centres. Density in Gangtok goes beyond 7000/sq.km and similar behaviour can be seen in other Urban Local Bodies as well. This shows the intensity of urban agglomeration and the State is witnessing rapid urbanisation. These factors pose challenges in solid waste management. Among the mountain states in India Sikkim has the steepest rise in altitude over the shortest distance. Most of the parts of the state are ecologically sensitive. Extreme weather like negative temperatures, snow falls, torrential rains and high humidity are additional challenges in handling solid waste in the State. Dense mountain folds make it difficult for commutation and aggregation of solid waste. With such high concentration of socio economic activities, land availability for any public utility becomes a

challenge for a local self government. Tourism being one of the major sources of income for the State, solid waste management becomes very important.

7. Best Practices

Over the past one decade, the State of Sikkim has come up with scalable models of solid waste management which are rooted in zero waste principles. The listed best practices below are noteworthy for its public participation, partnership among general public, government and NGOs, local solutions and local leadership to conserve nature.

(1) Lachen, North Sikkim

Lachen is a small village in the India-China border which attracts tourists from across the globe. The village was supported by Ministry of Tourism, Government of India under Endogenous Tourism Project in partnership with UNDP. The village council with the support of local community, district administration and NGOs launched campaigns to reduce waste and which resulted in ban on bottled water. Tourists were advised to use water from dispensers in the hotels instead of bringing in bottled water. Material recovery Facility was established in the village for segregated collection of non bio degradable discards and periodical clean ups were done to keep the premises clean. Lachen also demonstrated waste free festivals as a first initiative towards green protocol.

(2) Yuksam Trails

Khangchendzonga Conservation Committee (KCC) initiated a zero waste programme in Khangchendzonga national park in Yuksam. A MRF was set up at the entrance of the National Park for segregated collection and recovery of waste. A check post was maintained to inspect the tourists for the plastic disposable products they are carrying in. An inventory of plastics going into the national park was kept against a cash deposit and which is being reimbursed once the plastics are brought back.

(3) Tsomgo Lake

Tsomgo is a sacred lake on the way to NathuLa La from Gangtok. It is a busy tourist hub in the higher altitude. TsomgoPokhiriSamrakshanSamithi was formed by the local community to conserve the lake. Forest Environment and Wildlife Manage Department of Sikkim and WWF-India also joined the initiative for conservation of this high altitude lake. Water dispensers were installed along the shops to reduce the use of bottled water. Market was shifted from the banks of the Lake to prevent waste going into the lake. Periodical participatory clean ups and campaigns are still on to keep the lake town clean.

(4) Zero Waste Monastery

Pemayangtse Monastery located in West Sikkim has become the first zero waste monastery in Sikkim. Earlier the offerings brought by the local people were all packed food items. These offering received by the monastery would generate alot of plastic waste, in order to reduce the amount of waste generated, the members of monastery decided to encourage the visitors to bring offerings that wouldn't have plastic wrappers. The monastery also has water dispensers for the public. The monastery even received an award in the category of "Zero waste Religious Institutions"

(5) MelliDara Gram Panchayat.

Segregated waste collection and conversion of bio degradable waste into compost by Melli Dara GPU was a bold step towards zero waste. The GPU went ahead and started selling the processed compost under their brand. The GPU bagged recognition for their efforts towards Zero Waste.

(6) Gurudongmar Lake

WWF-India with the support of Lachen Tourism Development Council initiated a process to ban bottled water in a sacred – high altitude – glacier wetland in North Sikkim. It involved awareness campaigns and clean up drives.

(7) Gerethang Village

Gerethang Village is probably the first village in India to ban single use plastic cups, plates, Styrofoam plates and carry bags. The ban also followed promotion of eco friendly products in the region. This has inspired many Indian cities including the capital city of Kerala, Thiruvananthapuram to go ahead with banning single use plastic products.

(8) Green Protocol

The programmes organized by RMDD and UDHD have started following green protocol by eliminating single use plastics and including recycled products. PVC flex banners, plastic file folders etc were eliminated and notepads made of single side used paper was introduced in large quantities.

8. Principles for SWM

The guiding principles for Solid Waste Management in Sikkim is as follows, namely:-

8.1 Waste Reduction

The primary focus of Solid Waste Management shall be on waste reduction¹. Green protocol shall be made mandatory across all sectors to eliminate single use plastic products and to bring down use of low value small format plastics. The Government shall promote alternate products and services that can replace wasteful, ecologically unviable and unsustainable products.

8.2 Segregation at Source

Segregation² at source, segregated collection and transportation of solid waste shall be mandatory for solid waste management plans of Local Authorities across the State.

8.3 Resource Recovery

The Solid Waste Management systems will be oriented towards maximum recovery of resources from discards for recycling and reuse. Swap shops, Material Recovery

¹Sec.11(b), Solid Waste Management Rules 2016- Ministry of Environment, Forest and Climate Change – Govt. of India Notification 8th April 2016

²Sec.4(7), Sec.15(zg) iv, Solid Waste Management Rules 2016- Ministry of Environment, Forest and Climate Change – Govt. of India Notification 8th April 2016

Facilities(MRF)³ and Resource Recovery Centres will be used to ensure maximum recovery of resources.

8.4 No burning

Burning of solid waste is a destructive and polluting process; hence no solid waste shall be allowed to get disposed through open or closed burning, incineration⁴, co- incineration⁵, or any other thermal processes. Burning of biodegradable / recyclable materials shall be strictly prohibited. Moreover Energy recovery through thermal processing of solid waste in Sikkim is not feasible⁶.

8.5 Decentralized Solid Waste Management

No centralized solid waste management system shall be used except existing sanitary landfills for solid waste management in the State. The existing functional solid waste management processing / storing facilities shall be revived and supplemented with adequate decentralized processing / storing⁷ facilities to curb agglomeration of solid waste to central points.

8.6 Extended Producer Responsibility

'My Waste is My Responsibility' shall be the underlying principle, where individuals have to assume the responsibility of the waste generated in their premises. Industries, businesses and other bulk waste generators shall be responsible under Extended Producer Responsibility⁸ for source level segregation, storing and recovery of solid waste. The manufacturers, brand owners and distributors shall be held responsible and liable of collection, sorting, transportation, storing and recovery of plastics⁹, E-waste¹⁰, Hazardous waste and absorbent hygiene products. Government of Sikkim shall institute mechanisms with the support of State Pollution Control Board based on the provisions of Plastic Waste Management Rules 2016, E-Waste Management Rules 2016 and Hazardous Waste Management Rules 2016.

³Sec.3(31) Solid Waste Management Rules 2016- Ministry of Environment, Forest and Climate Change – Govt. of India Notification 8th April 2016

⁴ Incineration plant: any stationary or mobile technical unit and equipment dedicated to the thermal treatment of wastes with or without recovery of the combustion heat generated. This includes the incineration by oxidation of waste as well as other thermal treatment processes such as pyrolysis, gasification or plasma processes in so far as the substances resulting from the treatment are subsequently incinerated. (Directive 2000/76/EC of the European Parliament – 4 December 2000)

⁵ Co-incineration plant: any stationary or mobile plant whose main purpose is the generation of energy or production of material products (Directive 2000/76/EC of the European Parliament – 4 December 2000)

⁶"MSW can be incinerated autogenously if its calorific value is above 2400kcal/kg; if it is between 1500-2400 kcal/kg, incineration is possible with the aid of an auxiliary fuel. When the calorific value of the MSW is less than 1200-1500kcal/kg, incineration route is usually dismissed." Thermal properties of Indian Municipal Solid Waste Over The Past , Present and Future years and Its Effect on Thermal Waste To Energy Facilities-Roshni Mary SebastianandBabuAlappat Department of Civil Engineering, IIT Delhi, New Delhi, India (*Civil Engineering and Urban Planning: An International Journal (CIVEJ)* Vol.3, No.2, June 2016)

⁷Sec.3(15), Sec.15(m), Sec.15(v) Solid Waste Management Rules 2016- Ministry of Environment, Forest and Climate Change – Govt. of India Notification 8th April 2016

⁸Sec.3(21) Solid Waste Management Rules 2016- Ministry of Environment, Forest and Climate Change – Govt. of India Notification 8th April 2016

⁹Sec 9(1-5), Plastic Waste Management Rules 2016, Ministry of Environment, Forests and Climate Change, Govt. of India. 18th March 2016.

¹⁰Sec 3(t,u,v), Sec.5(1) a,b,d,g, Sec.5(2), Sec.5(3), Sec.5(6), Sec.5(7) E-Waste Management Rules 2016, Ministry of Environment, Forests and Climate Change, Govt. of India. 1st October 2016.

8.7 Integration

The informal sector – waste pickers and scrap dealers – will be integrated¹¹ to the State level Solid Waste management regime as primary partners. The informal sector will be represented¹² in State Level Advisory Body

The Government of Sikkim recognizes the role of informal sector which involves waste pickers and scrap dealers who are connected to the larger national network of recycling. Priority will be given to the informal sector when it comes to assign the right over discards / scrap materials. The waste pickers and scrap dealers will be identified and authorized to collect /receive, discards from public and government institutions for recycling. They will be integrated as partners of Solid Waste management network in the State of Sikkim.

8.8 Dignity of Labour

The services of people engaged in Solid Waste management will be recognized as environmental services and the people will be considered as skilled labour and or technicians. The services of cleaning, waste collection, transportation, sorting, disassembly, processing, recycling will be considered as environmental services which ensures environmental and public health. The people engaged in these jobs will be technically trained and updated periodically to elevate the status of such jobs. The State Government will ensure the dignity of labour by providing safe working environment, economic opportunity and social security for the people engaged in the environmental services. Campaigns will be directed towards marketing services related to waste

9. Strategy

Based on the characteristics, quantity of waste and sources of waste with given challenges mentioned the following strategy will help to achieve the mission of the State.

9.1 Waste reduction

The Government of Sikkim shall adopt a strategy for waste reduction¹³ and changing the characteristics of waste. Prevention is better than cure. It is imperative for any system of waste management to take steps to reduce waste. This not only helps the state to conserve natural resources, but also save public expenditure on solid waste management. Reduction in waste generation shall be achieved by judicious and efficient use of resources. Following mechanisms shall be adopted to reduce waste at source.

9.1.1 Green Protocol

Green protocol is a set of guidelines which help people to make decisions and choices for efficient resource use and management. It helps to save resources through promoting responsible resource use and eco friendly practices for sustainable development. The fundamental principle of Green Protocol is to avoid toxics, ecologically and economically unviable materials and practices, support local economy and ecosystems.

¹¹Sec.11(c), Sec.15(h), Solid Waste Management Rules 2016- Ministry of Environment, Forest and Climate Change – Govt. of India Notification 8th April 2016

¹²Sec 23(13) Solid Waste Management Rules 2016- Ministry of Environment, Forest and Climate Change – Govt. of India Notification 8th April 2016

¹³Sec (11.b) Solid Waste Management Rules 2016- Ministry of Environment, Forest and Climate Change – Govt. of India Notification 8th April 2016

Government of Sikkim shall use the provisions for creating rules/regulations under the Sikkim Panchayat Act 1993 and Sikkim Municipalities Act 2007 for incorporating Green protocol guidelines as mandatory for Houses, commercial establishments, Public and Private Institutions, religious institutions, Markets and Public events. The Green Protocol shall be made mandatory for licensing of buildings, trade, business, industry and all other activities in the Local Authority. A set of green protocol guidelines are provided in Annexure 16.1. This shall be mandatory for all Government office, institutions and events organized by or for Government of Sikkim. A timeline shall be defined in consultation with businesses, traders, industry and other commercial establishments to phase in green protocol in their day to day operations. Green protocol shall be applicable for educational institutions, research organizations, community centres and religious institutions. A comprehensive ban on sale and use of single use plastic carry bags, plastic plates, plastic cups, plastic cutleries, non woven poly propylene carry bags, single use plates made of multi layer plastics, food containers made of expanded poly styrene etc., shall be integrated in the byelaws of Local Authorities mandated under provisions to frame byelaws by Local Authorities under Rule 15(zf) of Solid Waste Management Rules 2016 in consultation with stakeholders.

9.1.2 Material Use Policy

Material Use Policy will primarily include the purchasing decisions of materials from an environment perspective. The main objective is to reduce waste products at least in our neighbourhood. These policies will assist in promoting practices that conserve natural resources, improve the public and worker health, and at the same time making a conscious financial decision. The event or the institution has to ensure the following guidelines are taken into account before the purchase or the decision is made.

Checklist for Material Use Policy with examples is attached as Annexure 16.2. This shall be incorporated in the *Chapter-10 Stores (General Rules) under Sikkim Financial Rules by Finance, Revenue & Expenditure Department*.

9.2 Segregation at Source

Segregation of waste at source is very important for efficient and safe handling of discards. 57% of waste generated in the state is biodegradable. From the balance 43% non-biodegradable waste, 33% is paper waste and 3% is plastic waste. Management of biodegradable waste is efficient when segregated. Recovery of recyclable material is enabled when non-biodegradable materials are separated for decaying material and sorted into categories. Thus, segregating waste into bio degradable and non biodegradable (Wet and Dry) itself will solve about 60-70% of the waste problem. Hence the Government shall make it mandatory¹⁴ for all households, commercial establishments, private and public institutions to follow minimum of two bin segregation at source. Segregated bio degradable discards shall be disposed through biological methods including vermi composting, aerobic composting or anaerobic digestion. Segregated non bio degradable discards shall be sent for further segregation and recovery at waste pickers / scrap dealers facility or Material recovery facility. The E-Waste and Hazardous Waste shall be sent to the designated / service providers authorized by Sikkim Pollution Control Board. Construction and Demolition Waste, the rejects / residuals including sanitary waste shall be sent to nearest landfill for final disposal.

¹⁴Sec. 4(7), Sec.15(zg) iv Solid Waste Management Rules 2016- Ministry of Environment, Forest and Climate Change – Govt. of India
Notification 8th April 2016

9.3 Decentralized Solid Waste Management and Disposal

Sikkim has very tough and undulating terrain. Since the availability of land for solid waste management is less. The Effort, cost and infrastructure required to transport waste generated from households to a common/centralised facility will reduce efficiency of the system. Decentralised mode of waste management has been suggested for hilly regions like Sikkim by the SWM Rules 2016¹⁵. Three tier system mentioned below shall be followed for effective mode of implementation.

9.3.1 Three tier system:

For a State like Sikkim, threetiers decentralized and overflow management system is suggested. They are:-

(a) Source level Systems – to minimise the efforts of collection and transportation of waste, management of bio degradable discards at homes / institutions / commercial establishments at source shall be promoted. Devices using aerobic composting or anaerobic digestion techniques shall be used for this.

(b) Cluster / Community Level Systems – Material Recovery Facilities at ward level / regional level shall be established to manage segregated bio degradable discards collected from clusters of households / institutions / commercial establishments and public places. Also this facility shall act as a collection cum storage centre segregated for non-bio degradable discards. This facility is also meant for receiving processed compost and or compost rejects from those who do source level composting. Public should be allowed to hand over segregated bio degradable waste on a daily basis directly to the MRFs or through engaging service providers. Public shall hand over segregated non bio degradable discards directly or through service providers at MRFs based on a collection timetable maintained by the MRFs.

(c) Common Facility – At Local Authority level a Resource Recovery Centre need to be established as Common Facility. The functions of RRCs are as follows;

Receive bio degradable and segregated non bio degradable discards from bulk waste generators which cannot be handled at MRFs

Receive processed or semi processed bio degradable discards from MRFs for final processing and composting

Receive segregated non bio degradable discards from MRFs and process them for recovery

Aggregate recyclables end to process for recycling, channelize inert, compost rejects, sanitary waste and residuals to landfill; channelize construction demolition waste to holding facility, channelize hazardous and E-Waste to authorized service providers. Common Facility will not receive any type of waste from public directly.

9.4 Sector wise intervention

Collection, transportation, processing requirements of waste varies with sector. Hence sector wise planning and intervention is suggested for efficient and safe waste management in the State. The sources of waste shall be divided into the following sector, and solid waste from each sector shall be collected and managed separately.

¹⁵Sec. 20(f) Solid Waste Management Rules 2016- Ministry of Environment, Forest and Climate Change – Govt. of India Notification 8th April 2016

- (i) Household sector
- (ii) Gated communities /Government. Quarters / Army camps / Residential Campuses of Educational Institutions or other institutions/Flats
- (iii) Commercial establishments
- (iv) Institutions
- (v) Markets
- (vi) Public Places / Roads
- (vii) Picnic spot / Tourist spots
- (viii) Fish / Meat Traders
- (ix) Restaurants and Hotels
- (x) Street vendors / hawkers
- (xi) Places of worship and Community halls

9.5 Incentives / Disincentives

Incentives shall be provided to those individuals, households & institutions that adopt Zero Waste systems and methods to reduce waste at source. The incentives shall be in the form of:

- (i) Subsidies for households to establish composting systems / kitchen gardening
- (ii) Subsidies for gated communities / flats to establish composting systems / MRFs / kitchen gardening
- (iii) Viability Gap Fund for participating scrap dealers which shall be availed from Government.
- (iv) Social security for waste pickers / waste traders
- (v) Viability Gap Fund for alternate products / services
- (vi) Awards / recognition for Green practices in each sector

Solid Waste Management Rules 2016 make it mandatory for all Local Self Governments to develop a bye-law¹⁶ on solid waste management in the region. The Local Authorities shall decide user fee, incentives, conditions for licensing, fines and other penal action for non compliance of directives of the Solid Waste Management Rules or Bye-laws.

10. Technology

Based on the geographical, climatic conditions and characteristics of waste it is found that thermal (burning) processing of waste is not feasible. Since the waste is dominated by bio degradable discards and the high humid climate adds to the water content to the wet waste, aerobic composting and or hi-tech anaerobic digestion is suggested as technologies to manage bio degradable discards.

10.1. Aerobic Composting

Aerobic Composting is the process of decomposing bio degradable discards into compost with the help of microbes. It is a natural process which may take 60-120 days for complete decomposing. Specially designed aerobic composting devices will reduce the number of days

¹⁶Sec.15(e) Solid Waste Management Rules 2016- Ministry of Environment, Forest and Climate Change – Govt. of India Notification 8th April 2016

required for composting, eliminate bad odour and will yield good quality compost. Process of composting will reduce the volume of waste to 20% besides eliminating germs which may harm public health. Proper aeration, carbon to nitrogen balancing, moisture balancing and supply of efficient micro organisms are crucial in composting process. In small quantity – household level- composting there are not much challenges with the available modern equipments. But the extreme weather conditions, relatively high humidity in some places may pose hurdles in large quantity composting. This shall be handled by specially designed aerobic composting cubicles which follow forced aerobic composting along with specially selected effective micro organisms.

10.2 Anaerobic digestion

Anaerobic digestion is the process of decomposing bio degradable discards in the absence of oxygen to produce biogas which is dominated by methane. India has long experience of a variety of biogas plant models. There are models available to treat waste as little as 2 kg / day to massive plants which can handle such as cooked food, meat or fish, modern hi-tech biogas plants (See Annexure 11.5) will be useful.

10.3 Selecting technology across different agro climate zone

Agro-Climate Zone	Temp.	Altitude	Region	Suggested Technology
Cool type	Less than 10°Celsius	2000 meters and above	North District, North East part of East District	For rural households: <ul style="list-style-type: none"> • <i>conventional insulated aerobic composting method in practice</i> For rural cluster / common facility: <ul style="list-style-type: none"> • <i>Forced Aerobic Composting with inoculums</i> For urban household: <ul style="list-style-type: none"> • <i>Door to door collection or daily drop off facility for bio degradable discards</i> For urban cluster / common facility: <ul style="list-style-type: none"> • <i>Forced Aerobic Composting with inoculums.</i> • <i>Mechanised composting equipments</i>
Moderate Type	10°-20° Celcius	1000 meters to 2000 meters	Southern parts of North District, Northern and Eastern parts of East District, Central parts of west and south districts, Southern most part of south and west districts.	For rural households: <ul style="list-style-type: none"> • <i>conventional insulated aerobic composting method in practice</i> • <i>Smart bin composting (Bokashi)</i> For rural cluster / common facility: <ul style="list-style-type: none"> • <i>Forced Aerobic Composting with inoculums</i> For urban household: <ul style="list-style-type: none"> • <i>Smart bin composting (Bokashi)</i> • <i>Door to door collection or daily drop off facility for bio degradable discards</i> For urban cluster / common facility: <ul style="list-style-type: none"> • <i>Forced Aerobic Composting with inoculums.</i> • <i>Mechanised composting equipments</i>
Warm Type	20°Celsius and above	Below 1000 meters	Southern most part of south and west	For rural households: <ul style="list-style-type: none"> • <i>conventional insulated aerobic composting method in practice</i>

			districts, low lying valleys between west, south and north districts	<ul style="list-style-type: none"> • <i>Smart bin composting (Bokashi)</i> • <i>Anaerobic digesters (Biogas Plants)</i> For rural cluster / common facility:- <ul style="list-style-type: none"> • <i>Forced Aerobic Composting with inoculums</i> • <i>Simple Aerobic Composting Units</i> For urban household:- <ul style="list-style-type: none"> • <i>Smart bin composting (Bokashi)</i> • <i>Aerobic bin composting</i> • <i>Vermi composting</i> • <i>Anaerobic digestion (Biogas Plants)</i> • <i>Door to door collection or daily drop off facility for bio degradable discards</i> For urban cluster / common facility:- <ul style="list-style-type: none"> • <i>Forced Aerobic Composting with inoculums.</i> • <i>Simple Aerobic Composting units</i> • <i>Vermi compost units</i> • <i>Community level hi-tech biogas plants</i>
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10.4 Animal Feed / Plantations

Another way of utilizing bio degradable waste is to use it as feed for animals or manure for plantations. Segregated cooked food waste from restaurants, hotels and community halls and un contaminated vegetable waste from markets shall be fed to Livestock. Bazaar Supervisors shall supervise the collection and transportation of such discards for the purpose of feeding animals. Local Self Governments shall make arrangements with farmers interested in receiving material for composting to channelize bio degradable discards from markets, meat shops, restaurants, community halls etc. The materials collected can be composted using trench composting method in the farms itself.

10.5 Resource Recovery

Non biodegradable discards shall be recovered or reused, provided they are collected separately and kept clean. Paper, plastic, metal, glass, textile, leather and rubber, construction demolition waste etc in the waste stream shall be made available for reuse / refurbish or recycling if they are kept clean and sorted. Resource Recovery Centre at the central level supported by Material Recovery Facilities at cluster / ward level will enable efficient collection, sorting and recovery of non bio degradable discards.

Many of the non bio degradable discards accrues economic value only after they are aggregated in sizeable quantities. Integration of local informal sector / scrap traders / waste pickers will improve the efficiency of recovery, by way of direct collection of valuable discards from source, secondary collection of less valuables aggregated in MRFs and RRC. This will reduce the volume of waste to be transported to MRFs, RRCs and final disposal facilities. This will also save energy, resources and disposal space in landfills. Organizing waste pickers and local scrap dealers to operate door to door collection of waste, operation and maintenance of MRFs and RRC will improve the recovery rates and will ensure uninterrupted flow of materials. Every Local Authority shall set up Cluster level Material Recovery Facilities and Central Level Resource Recovery Centres as mandated by Solid Waste management Rules 2016. The components of Resource Recovery are as follows

10.5.1 Waste Pickers

Active waste pickers in the region shall be organized and integrated to the formal system, to expand the potential of resource recovery through forward linkages to recycling network.

10.5.2 Scrap dealers / traders

Local waste traders shall be integrated to facilitate aggregation of non bio degradable discards, sorting, cleaning and diversion to recycling. The Government shall initiate a process to standardize the existing practices of scrap dealers to ensure occupational safety, pollution control and social security.

10.5.3 Swap Shops

Swap Shops are facilities which facilitate exchange of reusable goods like, garments, household equipments / utensils, books, furniture etc. Swap shops adds value to reusables by minor repair or refurbishing activities. This mechanism will reduce the consumption of newer products to an extent and will inculcate a culture for caring and sharing of materials in the community. Swap shops are taking place in different parts of the country as a solution for safe recovery of resources and resource conservation.

10.5.4 Material Recovery Facilities

MRF¹⁷ means a facility where non-compostable solid waste can be temporarily stored by the local body or any other entity mentioned in rule 2 or any person or agency authorised by any of them to facilitate segregation, sorting and recovery of recyclables from various components of waste by Government authorities or Self governing local bodies. Informal sector of waste pickers, informal recyclers or any other work force engaged by the local body or entity mentioned in rule 2 for the purpose before the waste is delivered or taken up for its processing or disposal to Material Recovery Facilities will attract only low value discards since the valuables are skimmed by informal sector at the source. MRFs are the local aggregation centres for low value non bio degradable discards like plastics, mixed paper, glass bottles etc. It shall also act as temporary storage space for house hold level hazardous waste and E-Waste.

10.5.5 Resource Recovery Centres

RRCs are larger common facilities at Local Authority level to integrate MRFs to add value to low value discards through sorting, cleaning, pre processing and aggregation. RRCs will hold house hold hazardous waste and E-waste and will facilitate its disposal through authorized service providers.

10.5.6 Construction and Demolition Waste sites

Rapid urbanization results in increased demand for building materials as well as increases the construction and demolition waste. These inert waste materials shall be collected and stored, processed for further use as daily cover for existing sanitary landfills and raw material for non structural construction as per the provisions laid in the Schedule II of Construction and

¹⁷Sec. 3(31) Solid Waste Management Rules 2016- Ministry of Environment, Forest and Climate Change – Govt. of India Notification 8th April 2016

Demolition Waste Management Rules 2016. Local Authorities¹⁸ shall be responsible for segregated collection, transportation and recycling of construction and demolition materials.

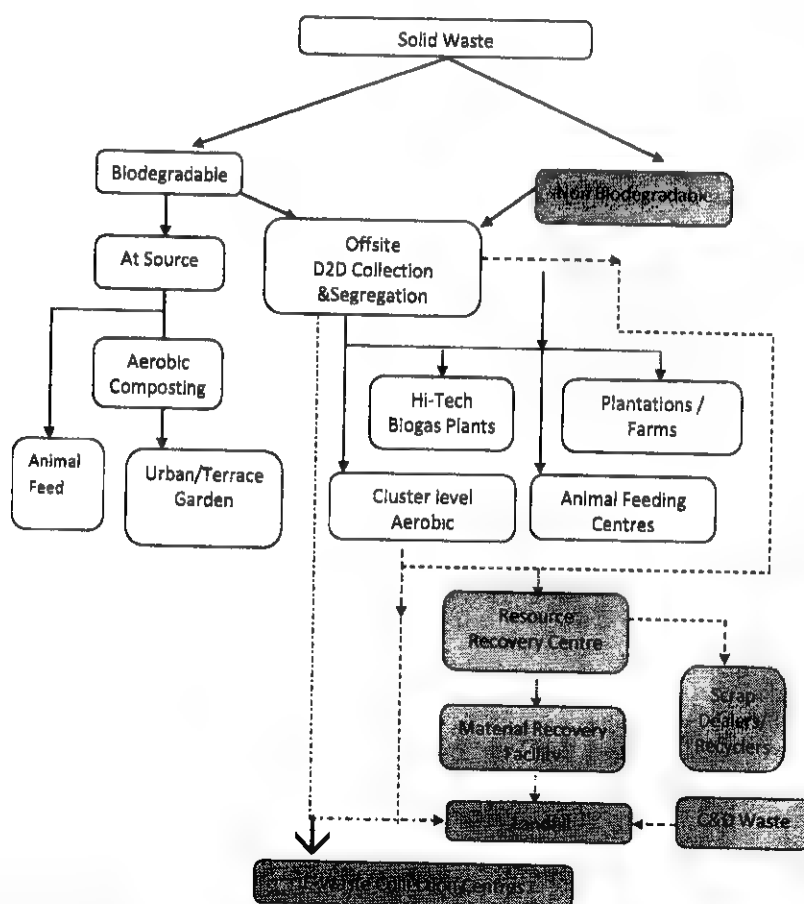
10.5.7 Landfills

Sanitary Landfills¹⁹ are the facility for disposing inerts, compost rejects and residuals in a scientific manner. In Sikkim there are Landfills for major Local Authorities. Considering the urbanization, the capacity of existing landfills and proposed landfills need to be used judiciously. Landfill space shall be shared between Urban Local Bodies as well as Gram Panchayat Units.

The landfill space shall be utilized with a timeline and targets. The volume capacity of the landfill needs to be divided by the estimated life of landfill. The annual quantity that can go into that landfill needs to be defined and further divided into monthly quota to ensure longevity of the landfill. Thus by calculating the monthly quota of volume utilisation from the estimated life, of landfill, each of dependent ULB or GPU shall be allotted monthly quota for landfill usage. Monthly quota shall ensure judicious use of landfill to ensure longevity of the facility.

11. Process of Solid Waste Management

Material flow of waste generated shall be as per the flow chart attached below. Details of the process are explained herewith.



¹⁸Sec.6, Construction and Demolition Waste Management Rules 2016, Ministry of Environment, Forests and Climate Change – Government of India. 26 March 2016

¹⁹Sec. 3(40), Solid Waste Management Rules 2016- Ministry of Environment, Forest and Climate Change – Govt. of India Notification 8th April 2016

11.1 Bio degradable discards

Segregation of waste at source provides choices for safe handling and or recovery of waste. The bio degradable waste shall be managed at source using aerobic composting or anaerobic digestion. The resulting compost shall be further used for urban gardening / kitchen gardening. The composting reject or excess compost or semi processed slurry from anaerobic digesters shall be brought to cluster level aerobic composting units attached to MRFs for further processing.

For people those who cannot afford to have source level management systems can either hand over the bio degradable discards directly to the cluster level aerobic composting facilities or they shall engage door to door collection service of authorized service providers to utilize the facility.

The service providers and or SafaiKarmacharis who pick up segregated bio degradable discards from households, commercial establishments, markets, public places or institutions may send them as animal feed for poultry / piggery farms, or may send them for trenching in plantations. Or they shall send it to the nearest aerobic composting unit in the cluster facility attached to the MRF. The excreta from animal farms shall be fed to the plantations or farms to complete the nutrient cycle. The compost generated at the cluster facilities shall be made available to the farms after value addition and standardization of quality. The compost rejects / slow decaying material will be sent to the Landfill.

11.2 Non Bio degradable discards

Non bio degradable discards shall be managed only offsite. Households, commercial establishments and institutions have choices to sell valuable non bio degradable discards to scrap traders or donate it to waste pickers. Waste generator shall drop segregated low value non bio degradable discards at nearest MRFs for free based on the collection time table of the MRF. Households, commercial establishments and institutions shall engage authorized service providers /SafaiKarmacharis / waste pickers / waste traders to haul their non-bio degradable discards on payment basis. Authorized service providers /SafaiKarmacharis / waste pickers / waste traders may skim the valuable discards and shall drop the low value discards to the MRFs. Scrap dealers in the region shall also utilize the MRFs or RRCs to hand over residuals for final disposal in landfill.

E-Waste and Hazardous Waste need to be handed over to MRFs directly or through authorized service providers. This shall further be channelized to service providers authorized by Government of India to dispose them.

Construction and demolition waste shall be dropped in sites assigned for it directly or through authorized service providers. This will be further processed to make it ready to use in construction purpose.

Sanitary waste, rejects / residuals accrued from MRFs, RRCs will be sent to landfill for final disposal.

The mixed waste collected by SafaiKarmacharis from public places and market shall be sent to MRFs and which will be channelized to Landfills after segregation

Suggested schedule of pickup of non bio degradable discards for MRFs are as follows.

- (a) Plastics waste and sanitary wastes shall be collected every day
- (b) Glass Bottles shall be collected on every 2nd Friday, Saturday & Sunday of the month
- (c) Paper / Cardboard wastes shall be collected on every 3rd Friday, Saturday & Sunday of the month
- (d) E-waste shall be collected on 4th Friday, Saturday & Sunday of January, April, July, October
- (e) Leather & Bags shall be collected on 4th Friday, Saturday & Sunday of March and September
- (f) Tube lights & Bulbs shall be collected on 4th Friday, Saturday & Sunday of February and August

Appropriate documentation be made at each level by authorized personnel and it should be made available to the Local Authority for monitoring purpose.

12. Infrastructure

For efficient SWM adequate and appropriate infrastructure is required. The infrastructure should be modular and need not be permanent. This will bring in flexibility in SWM. The SWM Rules 2016 suggests that organic waste be disposed through biological method using composting or anaerobic digestion. The Rules also specifies about non bio degradable discards which need to be sent for recycling. Based on this frame work the recommendation for Infrastructure is as follows.

12.1 Bio degradable discards

Bio degradable discards shall be managed at house hold level and or institutional level. The minimum infrastructure is recommended below for each sector. This list needs to be expanded with the support of a technical committee.

12.1.1 Source Level management

Simple and easy to use aerobic composters made of plastic, metal or earthen wares shall be used for composting at house hold level or institutional level, where the quantity of waste is less than 5 kg / day. These devices shall be operated with or without specially formulated effective micro organisms.

For households having waste more than 5 kg / day, anaerobic digestion coupled with composting for slurry management is suggested.

For institutions having waste from 10 kg – 50 kg per day shall opt for Aerobic Composting Bins

For institutions that do not have outdoor space shall opt for mechanized composting devices. The minimum waste requirement is 20 kg and can go up to 250 kg.

Institutions generating more than 500 kg bio degradable discard which are dominated by cooked food / meat / fish waste shall opt for hi-tech biogas plant.

12.1.2 Cluster Level management

At cluster level Aerobic Composting Bins shall be used to handle any quantity of waste. At places where it is affordable mechanized composting devices shall be used. Hi tech biogas plants (See Annexure – 16.5) are recommended for clusters where bio degradable discards are dominated by cooked food / meat and fish waste. Mobile aerobic composting units shall be made available to use it in temporary venues like expos. The Local Authorities with the support of district administration shall procure appropriate land / space available to set up cluster level aerobic composting facilities.

12.1.3 Common facility

At Common Facility Aerobic Composting Bins shall be used to handle any quantity of waste. Existing common facilities for composting shall be revived and modified or repaired for efficient functioning. A hi-tech biogas plant shall be attached to the composting facility to reduce the load of highly putrescibles in the compost bins.

12.2 Non biodegradable discards

For managing non bio degradable discards there are processing technology available. But they are neither worth / economical to try at city level nor economically sustainable. Hence minimum sorting, cleaning and storing of non bio degradable discards are recommended.

12.2.1 Cluster Level Management

At cluster level Material Recovery Facility is recommended. A MRF should have a minimum of 200 sq.ft. floor area to store non bio degradable discards. Mobile MRFs shall be set up for Local Authorities who cannot afford to find space for cluster level MRFs. MRFs can be larger colour coded bins which are manned by the Local Authority and is placed in places near markets, commercial streets etc.

The Local Authorities should make it mandatory to establish at every commercial establishment, a bin for taking back plastic packaging materials and containers. These bins at the premises of the commercial establishments can act as mini MRFs for plastic waste and shall be integrated with the waste pick up network of the Local Authority for final disposal.

The Plastic Waste Management Rules provide for EPR for manufacturers, brand owners and distributors of products that are packed in plastics. The Local Authority shall make the brand owners of leading noodles manufacturers, milk product manufacturers, breweries etc responsible for setting up cluster level MRFs or for supporting collection and transportation of single use low value plastic waste.

The LSGs shall conduct brand audit of plastic waste in the region to ascertain the share of brands and manufacturers to fix the responsibility.

12.2.2 Common Facility

At common facility it is recommended to have a Resource Recovery Centre which has facilities to clean, sort, shred, disassemble, and bale non bio degradable discards. RRC should have a minimum of 1000 sq.ft. floor area.

12.3 Construction and Demolition Waste Yard

Open or semi open yard with a minimum of 5000 sq. Feet need to be provided for stocking construction demolition waste for further process to make it available for construction purpose.

12.4 Hazardous Waste

Tubelights / CFL, batteries, medicines, paints and other household level chemicals forms the hazardous waste. The above mentioned categories of domestic hazardous wastes need to be stored safely till it is being disposed off through authorized service providers. A closed space with a minimum of 300 sq.ft floor area is required for this.

As per the provisions laid under Hazardous Waste Management Rules 2016, the Local Authority with the support of State Pollution Control board shall order the manufacturers / brand owners / association of traders to set up take back counters for Hazardous Waste collection.

12.5 E-Waste

Electronic and Electrical waste need to be kept under safe custody till it is being picked by the authorized service providers for safe disposal. A closed space with minimum of 300 sq. Ft. Floor areas is required for this.

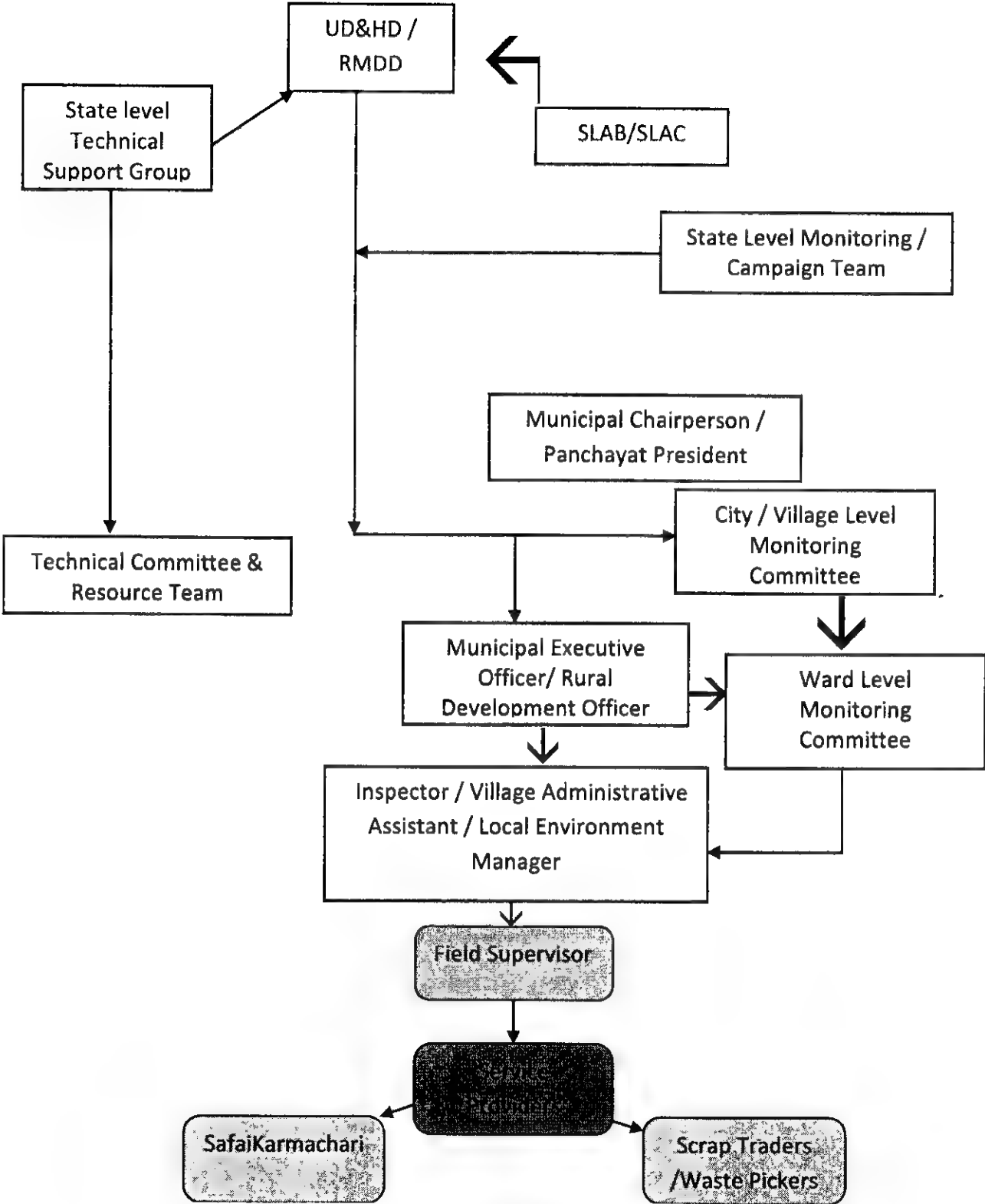
As per the provisions laid under E-Waste Management Rules 2016, the LSGs with the support of State Pollution Control board shall order the manufacturers / brand owners / association of traders to set up take back counters for E-Waste collection.

12.6 Inerts / residuals / Sanitary waste

For disposal of inert materials, residuals from recycling and composting, sanitary waste and other non recyclable waste a sanitary landfill is required.

13. Institutional Mechanism

Chart 2 Flow Chart of Institutional Mechanism



recovery. Involving informal market in the below mentioned methods can amplify efforts taken by the Local Authority to recover resources.

Scrap dealers / Agent / Waste pickers who have been active in the industry for 5 years or more shall be authorised / recognised by Local Authority. Authorised scrap dealers / Waste pickers shall buy / get donated material from any of the MRFs or RRC. Rate of sale of material from MRF or RRC would be decided by Local Authority in consultation with their representatives. Feedback from Informal market shall be used to fine tune categories of segregation in MRF and RRC. Network & logistics support of Informal market shall aid the implementation of EPR (Extended Producer Responsibility).

13.1.7 Service Providers

Zero Waste approach to Solid Waste Management opens up new opportunities in green services or environmental services. It also creates demand for certain professional services for which the Local Authority have to form service providers.

13.1.7.1 Environment Service Team

The Local Authority shall work with SHGs / NHGs or Waste Picker groups / NGOs / Social enterprises / Private agencies to provide door to door services in terms of segregated collection of waste, technical support for composting / biogas, technical support for organic farming / urban kitchen gardening, Supply of inputs for composting / biogas / organic farming etc. The services shall be availed for any households or commercial establishments on the basis of mutually agreed monthly subscription. The Local Authority shall authorize Environment Service Teams in different wards / clusters in the City to provide service for those who are willing to pay. Environment Service Team/Private Service Providers shall report their waste management activities to Bazaar Inspector/Local Environment Manager. Monthly reports detailing collection, treatment and forwarding shall be submitted to Bazaar Inspector/Local Environment Manager.

13.1.7.2 Green Protocol Services Team

Implementation of Green Protocol for events, celebrations, institutions will open up demand for professional service of Green Protocol Service. The Green Protocol Service will anchor procurement of Green products / services to ensure waste free event as well as ensure safe disposal of bio degradable waste. Setting up of Green Offices, sourcing of alternate products on customised orders, providing hiring services for reusable plates, cups, cutleries, water dispensing etc are some of the major functions of a Green Protocol Service. The Green Protocol team can collect service charge for their services from the clients. Functions of Green Protocol Service team shall be:-

- (a) Executing green protocol measures for large scale public / private events. Services provided by a Green Protocol Service Teams shall include segregated waste collection, composting / bio-methanization of biodegradable kitchen and food, safe recovery of non-biodegradable waste and handing over of collected non-biodegradable waste to responsible Urban Local Body authority.
- (b) Ensuring reduction in usage of single use materials during the event. This shall be achieved by making arrangements for alternate products.
- (c) Engaging with public participants to abide by Green Protocol guidelines.

GRAM PANCHAYAT UNITS

13.1.1 Secretary - RMDD

Secretary - RMDD shall assume the responsibility of implementation of State Policy on SWM and monitoring of the same in all Gram Panchayat Units. Secretary may delegate coordination, implementation and monitoring of the state policy to any of his team members in the rank of Mission Director / Under Secretary / Deputy Secretary.

13.1.2 Rural Development Officer

Rural Development Officer will be responsible for the effective solid waste management programmes and process at the Gram Panchayat Unit level. Rural Development Officer may take technical support and guidance from Technical Support Group and or City Level Monitoring team. Rural Development Officer shall engage NGOs, student community, and other people to launch campaigns to set the background for the comprehensive SWM programme for the City.

13.1.3 Local Environment Manager

Local Environment Officer needs to assume the responsibility of SWM of a ward or a division. The Local Environment officer shall monitor the health & sanitation of the area as well as be responsible for the general upkeep & safety of the natural environment of the Local Authority. The Local Environment Manager shall be empowered to integrate, monitor and regulate activities that would detriment the natural environment of the Local Authority.

13.1.4 Field Supervisor (Asst. Local Environment Manager)

The role of Field Supervisor shall also be elevated accordingly to supplement duties of Local Environment Manager and to assist him/her in carrying out his responsibilities regarding the upkeep & safety of the natural environment of the Local Authority.

13.1.5 SafaiKarmacharis (Sanitation Workers)

SafaiKarmacharis need to be trained in segregation of waste, basics of composting, organic urban gardening, data collection for vector index etc. Besides the cleaning up job, they need to be elevated as local trainers for people who are working in housekeeping sector of major commercial establishments. This will ensure uniform standard operating procedure in segregation, collection and transportation of materials.

13.1.6 Scrap Dealers / Waste Pickers

Informal market and scrap dealers contribute in a significant way to link non biodegradable resources from households to recyclers. Recognising authentic and reliable agents/scrap dealers would incorporate them into the system and their network / links could be used for effective resource recovery. Involving informal market in the below mentioned methods can amplify efforts taken by the Local Authority to recover resources.

Scrap dealers / Agent / Waste pickers who have been active in the industry for 5 years or more shall be authorised / recognised by Local Authority. Authorised scrap dealers / Waste

pickers shall buy / get donated material from any of the MRFs or RRC. Rate of sale of material from MRF or RRC would be decided by Local Authority in consultation with their representatives. Feedback from Informal market shall be used to fine tune categories of segregation in MRF and RRC. Network & logistics support of Informal market shall aid the implementation of EPR (Extended Producer Responsibility).

1.31.7 Service Providers

Zero Waste approach to Solid Waste Management opens up new opportunities in green services or environmental services. It also creates demand for certain professional services for which the Local Authority have to form service providers.

13.1.7.1 Environment Service Team

The Local Authority shall work with SHGs / NHGs or Waste Picker groups / NGOs / Social enterprises / Private agencies to provide door to door services in terms of segregated collection of waste, technical support for composting / biogas, technical support for organic farming / urban kitchen gardening, Supply of inputs for composting / biogas / organic farming etc. The services shall be availed for any households or commercial establishments on the basis of mutually agreed monthly subscription. The Local Authority shall authorize Environment Service Teams in different wards / clusters in the areato provide service for those who are willing to pay. Environment Service Team/Private Service Providers shall report their waste management activities to Bazaar Inspector/Local Environment Manager. Monthly reports detailing collection, treatment and forwarding shall be submitted to Bazaar Inspector/Local Environment Manager.

Environment Service Team shall also be mandated to provide Green Protocol Services as per the request of households / commercial establishments / government offices. Functions of a Green Protocol Service Team in a ULB shall be carried out by Environment Service Team in a GPU.

Implementation of Green Protocol for events, celebrations, institutions will open up demand for professional service of Green Protocol Service. The Green Protocol Service will anchor procurement of Green products / services to ensure waste free event as well as ensure safe disposal of bio degradable waste. Setting up of Green Offices, sourcing of alternate products on customised orders, providing hiring services for reusable plates, cups, cutleries, water dispensing etc are some of the major functions of a Green Protocol Service. The Green Protocol team can charge fees for their services to the clients. Functions of Green Protocol Service team shall be:-

- (a) Executing green protocol measures for large scale public / private events. Services provided by a Green Protocol Service Teams shall include segregated waste collection, composting / bio-methanisation of biodegradable kitchen and food, safe recovery of non-biodegradable waste and handing over of collected non-biodegradable waste to responsible Urban Local Body authority.
- (b) Ensuring reduction in usage of single use materials during the event. This shall be achieved by making arrangements for alternate products.
- (c) Engaging with public participants to abide by Green Protocol guidelines.

13.2 Mechanism for enabling and monitoring

A monitoring system is very important to troubleshoot and streamline the SWM programmes. It also provides for community participation and ownership of the programme. A mechanism to enable participation and monitoring is suggested as below.

13.2.1 Bye-Laws

The Local Self Governments shall frame bye-laws for effective management of solid waste in the region. UDHD and RMDD shall facilitate to develop a template Bye-Law that can be adapted by the Local Authorities with modifications to suit their local demand. The Bye-Law shall incorporate necessary provisions from Solid Waste Management Rules 2016, Plastic Waste Management Rules 2016, Construction and Demolition Waste Management Rules 2016, E-Waste Management Rules 2016, Hazardous Waste Management Rules 2016. The Bye-Laws shall bring in regulations and or bans on specific materials, products or processes. The Bye-Laws shall incorporate incentives as well as disincentives for effective implementation of solid waste management rules.

13.2.2 State Level Advisory Board / State Level Advisory Committee

Government of India have made it mandatory²⁰ for all State Governments to form a State Level Advisory Board for Solid Waste Management and State Level Advisory Committee²¹ to monitor plastic waste management. The same committee shall be the apex body for the monitoring of Solid Waste Management Programmes in the State.

13.2.3 State Level Campaign / Monitoring Team

A committee chaired by Secretary and convened by Mission Director / Under Secretary / Deputy Secretary, as instructed by the Secretary, may be formed with following representatives as members for periodical evaluation and running the state level campaign for Zero Waste approach to Solid Waste Management. Separate Campaign / Monitoring team shall be formed for UD&HD and RMDD.

Members:

- (a) All Municipal Chairpersons/ Panchayat Presidents
- (b) Representatives of Local Authority(ULB/GPU) level Monitoring Committee
- (c) Representatives from Tourism Department and Forests Environment and Wildlife Management Department.
- (d) Local Authority Level Technical Support group representatives
- (e) Local Authority Level Resource Group representatives
- (f) NGOs & Civil Society Organisations

²⁰Sec. 23 Solid Waste Management Rules 2016- Ministry of Environment, Forest and Climate Change – Govt. of India Notification 8th April 2016

²¹Sec. 16 Plastic Waste Management Rules 2016- Ministry of Environment, Forest and Climate Change – Govt. of India Notification 18th March 2016

Role:

- (i) The State Level Campaign / Monitoring team shall review the participation of public in utilising facilities commissioned by all Local Authorities for decentralised waste management. Elected head of Local Authority Municipality Chairperson / Gram Panchayat President would provide the update from the Local Authorities.
- (ii) The State Level Campaign / Monitoring team shall initiate suitable campaign to increase awareness among the public to urge them to compost & to segregate
- (iii) The State Level Campaign / Monitoring team shall communicate difficulties faced by current system in accessing/using infrastructure established by the Local Authority for Decentralised Waste Management to UD&HD, RMDD and to SLAC/SLAB.
- (iv) The State Level Campaign / Monitoring team shall review the progress of material flow to Landfill and recommend necessary course correction measures in Policy and Campaign to extend the life of all three landfill facility.
- (v) The State Level Campaign / Monitoring team shall recommend measures for improving the existing system from their previous experience/learning to UD&HD, RMDD and to SLAC/SLAB
- (vi) The State Level Campaign / Monitoring team shall take recommend capacity building exercises for executives and staff involved in decentralised waste management to improve system efficiency.
- (vii) The State Level Campaign / Monitoring team shall meet once in 3 months.

13.2.4 State Level Technical Support / Resource Group

A committee chaired by a Technical Expert in the State and convened by Mission Director / Under Secretary / Deputy Secretary, as instructed by the Secretary, may be formed with the following members to provide technical support in implementing Solid Waste Management Programmes in the State.

Members:

- (a) Technical experts on composting
- (b) Technical experts on bio-methanisation
- (c) Technical experts on recycling & plastics
- (d) Technical experts on Material handling and Operations
- (e) Technical experts on Geology & Environmental Science
- (f) Representatives NGO & Civil Society Organisation who are engaged in issues related to waste and or environment

Role:

- (i) The Technical Support / Resource group shall advise UD&HD / RMDD on matters related to Decentralised Solid Waste Management.
- (ii) The Technical Support / Resource group shall inspect and recommend the Private Waste Management Service Providers / Environment Service Group for approval from UD&HD / RMDD

- (iii) The Technical Support / Resource group shall enlist and recommended list of materials that shall be forwarded to landfill for approval from UD&HD / RMDD
- (iv) The Technical Support / Resource group shall recommend list of approved technology for household composting and Hi-tech bio-methanation units for approval from UD&HD / RMDD
- (v) The Technical Support / Resource group shall review DPR prepared for Sanitary Landfill for rejects, C&D Waste handling facility, E-waste handling facility
- (vi) The Technical Support / Resource groups shall suggest improvements in the system established for decentralised waste management
- (vii) The Technical Support / Resource group shall meet once in months and as per functional requirement.

13.2.5 Local Authority Level Technical support group / Resource Group

A committee chaired by a reputed technical expert from the locality and convened by Municipal Executive Officer / Village Development Officer. People with different faculties and NGO representatives shall be nominated to this committee who shall assist the City to take decisions, shape projects and campaigns.

Members:

- (a) Technical experts on composting
- (b) Technical experts on bio-methanisation
- (c) Technical experts on recycling & plastics
- (d) Technical experts on Material handling and Operations
- (e) Technical experts on Geology & Environmental Science
- (f) Representatives NGO & Civil Society Organisation that are associated with Zero Waste

Role:

- (i) Provide guidance on the operation of Decentralised Waste Management System in the city
- (ii) Recommend additional infrastructure as per demand to handle waste generated in the city
- (iii) Recommend and conduct training for staff who is implementing the State Policy on Solid Waste Management with a Zero Waste approach.
- (iv) Guide institutions and other communities as when required to implement Zero Waste systems
- (v) The group shall meet once in a month

13.2.6 Local Authority Level Monitoring Committee

A committee chaired by head of Urban Local Body / Gram Panchayat Unit and assisted by Municipal Executive Officer / Rural Development Officer. The committee will have all elected representatives, representatives from clusters / ward level committees, invited experts and NGO representatives.

Members:

- (a) Elected representatives
- (b) Representatives from Ward/Cluster level committees
- (c) Representatives from Educational institutions (preferably teaching staff)
- (d) Representatives from youth clubs
- (e) Experts working on Public Health, Sanitation and Waste Management
- (f) Environmental activists & Educational activists
- (g) NGO & Civil Society Organisation representatives
- (h) Representatives from Business community (Shopkeepers, Hoteliers, Traders, Workshop owners etc.)
- (i) Representatives from house owners and residents.

Role:

- (i) The groups shall review the participation of public in utilising facilities commissioned by the Local Authority for decentralised waste management. Ward representative shall communicate situation in each of the wards.
- (ii) The groups shall initiate suitable campaign to increase awareness among the public to urge them to compost & to segregate
- (iii) The groups shall communicate difficulties faced by current system in accessing/using infrastructure established by the Local Authority for Decentralised Waste Management to Municipal Executive Officer (MEO) / Rural Development Officer (RDO)
- (iv) The groups shall identify & report lapses from UD&HD /RMDD staff in implementing and in the general upkeep of Zero Waste infrastructure to MEO / RDO
- (v) The groups shall recommend measures for improving the existing system from their previous experience/learnings to MEO / RDO
- (vi) The group shall meet once in a month

13.2.7 Ward / Division level / Cluster level Monitoring Committee

A committee chaired by elected representative and assisted by Bazaar Inspector. The committee shall have cluster (Sector) representatives such as hotels and restaurants, traders, educational institutions, general public, NGOs and others.

Members:

- (a) Representatives from Teaching community
- (b) Representatives from youth clubs
- (c) Representatives from Business community (Shopkeepers, Hoteliers, Traders, Workshop owners etc.)
- (d) Representative from house owners and residents

Role:

- (i) The groups shall review the participation of public in utilising facilities commissioned by the Local Authority for decentralised waste management. Ward representative shall communicate situation of their ward in the city level monitoring committee.
- (ii) The groups shall initiate suitable campaign to increase awareness among the public to urge them to compost & to segregate
- (iii) The groups shall communicate difficulties faced by current system in accessing/using infrastructure established by the Local Authority for Decentralised Waste Management to city level monitoring committee.
- (iv) The groups shall identify & report lapses from UD&HD /RMDD staff in implementing and in the general upkeep of Zero Waste infrastructure to city level monitoring committee.
- (v) The groups shall recommend measures for improving the existing system from their previous experience/learnings to city level monitoring committee.
- (vi) The group shall meet once in a month.

14. Capacity building / IEC

The goal of Zero Waste shall be achieved only when the public internalize the zero waste principles and bring in qualitative change in behaviour. This is possible through creating enabling environment with infrastructure, institutional mechanism and policy. Training, orientation, sensitizing and motivation are required to build capacity in people who implement the project as well as the beneficiaries.

14.1 Inspector / Village Administrative Assistant (Local Environment Manager)

It is recommended to elevate the post and functions of Bazaar Inspector/ Village Administrative Assistant to motivate people and to assume more responsibilities that require technical skill and knowledge. Additional faculties requirement for this post are as follows.

- (i) Technical knowledge on composting / biogas
- (ii) Operation and maintenance of Resource recovery / Segregation
- (iii) Public health monitoring and reporting
- (iv) Basic knowledge in eco system and Biodiversity
- (v) Basic understanding in Toxics etc.
- (vi) Documentation and reporting

14.2 Field Supervisor (Asst. Local Environment Manager)

Field supervisor assists the LEM. Hence it is desirable to train the Field Supervisor to accrue knowledge in the following.

- (i) Resource recovery / Segregation
- (ii) Public health monitoring and reporting
- (iii) Basics of composting and biogas

- (iv) Basics of organic farming
- (v) Documentation

14.3 SafaiKarmacharis (Sanitation Workers)

SafaiKarmacharis or Sanitation workers are currently engaged in cleaning of premises, collection on solid waste from households and from collection points on main roads. They need to be trained as trainers for the local community. They should be able to demonstrate right way of segregation of waste, composting, biogas operation etc. This will elevate the status of the SafaiKarmacharis.

14.4 Environment Service Team (Private Service Provider)

Zero Waste opens up green job opportunities. There will be demand for professional services for selection of waste management technology, operation and maintenance, consultation on organic urban gardening, troubleshooting in organic farming, energy audit, supply of farming and waste management inputs and devices etc. Environment Service Team shall take up this as a business model and provide professional services to households and institutions on payment basis.

14.5 Waste Pickers / Scrap Dealers

Often waste pickers and scrap dealers resort to crude mechanism to recover valuable materials from mixed or segregated waste. This results in occupational hazard and contamination of valuable materials. Waste pickers / Scrap dealers need to be trained for safe recovery of materials before recognizing them as authorized recyclers in the region. The Local Authority should provide free periodical medical check up and medical insurance for their health care. Green Protocol Services Team

14.6 Green Protocol Services Team

Local Authorities have to help mobilize Green Protocol Team as social enterprises to provide technical and professional services to organize green events, green offices, green homes etc. Young enterprising youth shall be trained in fundamentals of Zero Waste to take up this as a profession.

14.7 Housekeeping workers

Developing a standard operating procedure for housekeeping in hotels, restaurants, offices and other institutions will help to have a uniform waste segregation and disposal system throughout the State. Field Supervisors or SafaiKarmacharis shall be utilized for training and demonstrations.

14.8 Shopkeepers / Vendors / Hawkers

Shop keepers, vendors and hawkers need to be exposed to alternate products, processes that will reduce use of plastics. They should be trained in source segregation, waste reduction tactics etc. This will ease off burden on cluster facilities for solid waste management.

14.9 Government Offices

Government Offices, especially public offices should be the place of demonstration for model practices of solid waste handling. Source segregation with colour coded bins, composting, resource recovery, green protocol etc should be practiced in the Government offices and other institutions.

14.10 Public

An enabling campaign for general public should be planned and it should continue for a minimum of 3 years. The campaign should address specific local issues, behavioural issues of people, best practices etc. The health impacts of burning of waste especially plastics shall be one of the main theme to prevent littering and burning of waste. Health impact of plastics and its impact on our environment shall be shared in public to build a public opinion to reduce the use of plastics.

Initiation of proper and scientific education on menstruation with the support of Department of Health will empower young girls of reproductive age and women in choosing right solution for menstruation. The Local Authorities with the support of State Government shall initiate napkin vending machines which will dispense plastic and toxic free disposable napkins and or reusable cloth napkins.

Subsidies and financial support shall be provided to enterprising people who are interested in taking up the businesses of alternate eco friendly products and services.

14.11 Tourists

Sikkim is a paradise for tourists who are in search of beauty of nature. Sikkim is ecologically sensitive area and it receives a large number of tourists from across the globe. The hospitality industry and commercial establishments in Sikkim is the direct beneficiary of the tourism industry. Tourism is also a sensitive industry when it comes to rules and regulations. The Government of Sikkim through the Department of Tourism and with the support of tour operators shall launch a campaign to advertise the salient features about new approach towards safe handling of solid waste. The relevance of such approach for conservation of natural resources and responsible tourism shall be pitched in the messages to create awareness among tourists well before their arrival in Sikkim. Technical support of Forests, Environment and Wildlife Management Department, Eco Tourism and NGOs shall be sought to package the messages. A package of practices for responsible tourism shall be developed along with standard practices for material use, recovery and safe disposal in the tourism / wildlife places.

14.12 Students / Youth

Campaigns, projects and activities shall be designed for involving students and youth in the State to invoke sense of ownership and to sustain the campaign. Local Authorities shall create opportunities for academic exercises on waste, material use, behaviour change communication, social work, rural planning etc, where the students and youth can participate. The Human Resource Development Department shall initiate process to integrate clubs in the educational institutions to create an environment for the campaign on waste management.

15. Way forward

The next steps of this document is explained as follows, namely:-

- (1) Action Plan – an action plan based on the policy document be prepared with public consultation. The action plan should have mile stone tangible goals.
- (2) Bye law – A Bye law for SWM in Local Authorities shall be drafted along with Bye-law for Plastic Waste Management at Local Authority level. It is recommended to have uniform bylaws for every Local Authority
- (3) Standards – A technical guide explaining the standard dimensions and cost of each technology, devices, processes need to be prepared with the help of a technical team. This guide should have standard operating procedures for MRFs, RRCs, Landfills, formats for documentation, agreement etc.

16. Annexure

16.1 Green Protocol guidelines

Guidelines:

- (1) Phase out all disposable products especially made of plastics and or multilayers. Avoid single use throw away products, plastic carry bags, non woven poly propylene carry bags, cups / plates / cutleries made of plastic / Styrofoam / multi layers/ tetrapacks, straws etc.
- (2) Phase out products with micro beads, micro plastic fibres. Products such as face wash, cigarette filters, pillows with micro fibre fillings, bean bags need to be avoided
- (3) PVC flooring / wall papers, toys made of PVC, PVC curtains / PVC Flex banners, need to be avoided
- (4) Do not use plastic bottles as drinking water bottles / infant feeding bottles
- (5) Avoid bottled water. Carry refillable water bottle and consume fresh juices / local beverages. Ensure water dispensers in the events
- (6) Buy in bulk and buy local to reduce plastic packaging
- (7) Carry cloth bags / containers for shopping to avoid disposable bags and containers
- (8) Share reusable materials and products with people whom you know.
- (9) Do not burn waste especially plastic.
- (10) Do not use plastic decorative at home, Stay away from recycled and cheap plastic products like toys / utensils.
- (11) Segregate discards at homes / Institutions / events into bio degradable, paper, plastics, glass, metal, and hazardous.
- (12) Do compost at home / utilize biogas plant to recover bio degradable waste.
- (13) Grow organic vegetables at home / roof top / balcony, wherever you can.
- (14) Shift to LED lighting, Brushless DC fans and other energy efficient devices including wind/ solar energy as alternate source of energy.

- (15) Utilize energy efficient cooking / heating devices such as pressure cooker, solar cooker, solar water heater, solar dryers, thermo boxes, energy efficient stoves etc.
- (16) Phase out use of pesticides and detergents at home
- (17) Install proper and scientific septic tank for your conventional flush toilets.
- (18) Make a soak pit to manage grey water at home / grow herbs or grass like plantains, yams, vetiver grass, lemon grass etc. to purify grey water

16.2 Material Use Policy

The idea behind Material Policy is to create a sustainable environment in offices, and to contribute towards becoming a green earth. There are ways in which we can create a Green office. The conscious measures taken towards making an eco-friendly institution will change the overall approach towards the Green Protocol. Material Policy will primarily include the purchasing decisions of materials from an environment perspective. The main aim is to reduce waste products in the office / institutions. These policies will assist in promoting practices that conserve natural resources, improve the public and worker health, and at the same time making a conscious financial decision. The office has to ensure the following guidelines are taken into account before the purchase or the decision is made.

Check list for green procurement

- (1) Necessity – Double check whether the intended product is necessary. Check whether the same utility is available from a similar product which is already purchased and left unutilized. Check whether an existing product can be upgraded for sharing. For example keeping stationery in a common space in the office so that everyone in the office can access will eliminate buying stationery for each table.
- (2) Next best alternative – Enquire for alternative products and or options for the intended product/service. Weigh the pros and cons before making a purchase.
- (3) Environmental Stewardship / EPR – Check with the manufacturer / supplier to ensure there is adequate environmental stewardship / Extended Producer Responsibility attached to the product, where the supplier / manufacturer is willing to share the responsibility of final dispose.
- (4) Durability – Check whether the product is durable or disposable. Also ensure that the product is future ready and will not get obsolete in a short span of a time.
- (5) Reusability /Recyclability – Check whether the product can be reused with maintenance, upgradation or it can be recycled at the end of its life period.
- (6) Toxicity – Check for less toxic products, or product with minimum toxic burden
- (7) Local Livelihood – Check whether the product support local livelihood, promotes local economy.

16.3 Aerobic Compost Bin

Aerobic Compost Bin is a simple compost device and method developed by Kerala Agriculture University. It was developed by Dr. Francis Xavier of Kerala Veterinary University in Kerala. This model is being used widely for solid waste management in urban areas where availability of land for waste management is very low. It can be installed along the foot path or even on a platform with wheels for mobility.

It is one of the efficient model of composting which have no odour and need less labour since it do not have turning process for composting. The technology is open source and simple. Basically the structure is a cubicle bin having length, width and height of 4 feet. The bin is perforated from four sides for aeration.

The process of composting is as follows

6" layer of dry leaves are made at the bottom of the bin and efficient micro organism or cowdung slurry is sprinkled over it. Another 6" layer of waste for composting is made on the top and it is again covered with dry leaves. The process continues till the bins are full and leaves it for curing for 60-90 days.

16.4 Mechanized Composting Devices

Mechanized composting devices speed up the process of composting to reduce the number of days for composting. These electric machines, grinds the waste and balances the moisture by absorbing it with heat. Then micro organism is mixed with it and turned for a specific period. The machine will produce stabilized organic matter ready for compost in 2 to 3 hours of time. The material need to be kept for another 10-15 days for curing. These machines are compact and can be installed inside large institutions or open terrace or outdoors.

16.5 Hi-Tech Biogas Plants

The challenge of large volume biogas plants (above 500 kg capacity) is that it requires daily monitoring and intervention to maintain the microbial action inside the digester and managing the gas produced. The feeding waste need to be pulverized and pre treated before feeding in. There should be systems to monitor temperature, pH, gas pressure inside the digester on a real-time basis. There should be systems to scrub the biogas to get 99.9% purified methane and systems to compress and store it for consumption. Modern biogas plants provide all these features besides safety feature without compromising the space requirement.